

Exogenous marker-engineered mesenchymal stem cells detect cancer and metastases in a simple blood assay.

Journal: Stem Cell Res Ther

Publication Year: 2015

Authors: Linan Liu, Shirley X Zhang, Rangoli Aeran, Wenbin Liao, Mengrou Lu, George Polovin, Egest J
Pone, Weian Zhao

PubMed link: 26391980

Funding Grants: CIRM Stem Cell Research Biotechnology Training Program at CSULB

Public Summary:

INTRODUCTION: Mesenchymal stem cells (MSCs) are adult multipotent stem cells that possess regenerative and immunomodulatory properties. They have been widely investigated as therapeutic agents for a variety of disease conditions, including tissue repair, inflammation, autoimmunity, and organ transplantation. Importantly, systemically infused MSCs selectively home to primary and metastatic tumors, though the molecular mechanisms of tumor tropism of MSCs remain incompletely understood. We have exploited the active and selective MSCs homing to cancer microenvironments to develop a rapid and selective blood test for the presence of cancer. **METHODS:** We tested the concept of using transplanted MSCs as the basis for a simple cancer blood test. MSCs were engineered to express humanized Gaussia luciferase (hGluc). In a minimally invasive fashion, hGluc secreted by MSCs into circulation as a reporter for cancer presence, was assayed to probe whether MSCs co-localize with and persist in cancerous tissue. **RESULTS:** In vitro, hGluc secreted by engineered MSCs was detected stably over a period of days in the presence of serum. In vivo imaging showed that MSCs homed to breast cancer lung metastases and persisted longer in tumor-bearing mice than in tumor-free mice ($P < 0.05$). hGluc activity in blood of tumor-bearing mice was significantly higher than in their tumor-free counterparts ($P < 0.05$). **CONCLUSIONS:** Both in vitro and in vivo data show that MSCs expressing hGluc can identify and report small tumors or metastases in a simple blood test format. Our novel and simple stem cell-based blood test can potentially be used to screen, detect, and monitor cancer and metastasis at early stages and during treatment.

Scientific Abstract:

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